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DEVELOPMENT OF NATURAL-POZZOLAN BASED ALKALI ACTIVATED CONCRETE INCORPORATING NANO-SILICA

by

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Doctor of Philosophy

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IN THE NAME OF ALLAH, MOST GRACIOUS, MOST MERCIFUL

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DEDICATED TO

MY PARENTS

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LIST OF ABBREVIATIONS

A:	Aluminosilicate,
AAB:	Alkali activated binder
AAC:	Alkali activated concrete
AAS:	Alkali Activated Slag
Ar:	Anorthite,
ASTM:	American Society for Testing of Materials
C/N-A-S-H:	Calcium/Sodium-Alumina Silicate Hydrate
C:	Calcite
CA:	Cristobalite alpha,
C-A-S-H:	Calcium-Alumina-Silicate-Hydrate
CE:	Counter Electrode
C-S-H:	Calcium Silicate Hydrate,
D:	Diopside,
EDS:	Energy Dispersive Spectroscope
FA:	Fly ash
Fr:	Forsterite,
FTIR:	Fourier Transform Infra-Red
G:	Gypsum,
GGBFS:	Ground granulated blast furnace slag
GHG:	Green House Gas
H:	Hematite
LOI:	Loss on Ignition
LPR:	Linear Polarization Resistance
LVDT:	Linear Variable Displacement Transducer
MIP:	Mercury Intrusion Porosimetry
N-A-S-H:	Sodium-Alumina-Silicate-Hydrate
NMR:	Nuclear Magnetic Resonance
NP:	Natural pozzolan
$nSiO_2$:	Nano-silica
OPC:	Ordinary Portland cement

P:	Portlandite $Ca(OH)_2$
P:	Philipsite
POFA:	Palm oil fuel ash
Q:	Quartz
RE:	Reference Electrode
RF:	Radio Frequency
SCE:	Saturated Calomel Electrode
SCMs:	Supplementary cementitious materials
SEM:	Scanning Electron Microscope
SF:	Silica fume
SH:	Sodium hydroxide
SS:	Sodium silicate
TAA:	Total Alkaline Activator
VPV:	Volume of permeable voids
WE:	Working Electrode
XRD:	X-ray Diffraction
XRF:	X-Ray Fluorescence
Z:	Zeolite Y

LIST OF SYMBOLS

°	Degree
°/min	degrees/minute
°C	Degree Celcius
μA/cm^2	Micro ampere/centimeter square
μm	Micro-meter
cm^{-1}	Per centimeter
cm^3	Cubic centimeter
cps	Cycles per second
gr	Gram
gr/cm^3	gram/cubic centimeter
gr/mol	gram/mol
gr/cc	gram/cubic centimeter
Gt	Gigaton
h	Hour
kg/m^3	Kilogram per cubic meter
kN	Kilo Newton
kN/sec	Kilo Newton per second
kV	Kilo Volts
kΩ.cm^2	Kilo ohm square centimeter
M	Molarity
m^2/gr	Square meter/gram
m^2/kg	Square meter/kilogram
m^2/s	Square meter/second
mA	Milli ampere